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RESPONSE UNDER 37 C.F.R. § 1.116
EXPEDITED PROCEDURE
EXAMINING GROUP 2600

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

First Named Inventor	: Ikko Fushiki et al.	
Appln. No.	: 09/452,658	
Filed	: December 1, 1999	Group Art Unit: 2672
For	: METHOD AND APPARATUS FOR TRANSFORMING AND RENDERING GRAPHICAL CURVES	Examiner: T. Havan
Docket No.	: M61.12-0179	

RESPONSE AFTER FINAL

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Commissioner for Patents
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Sir:

This is in response to the Final Office Action mailed on April 23, 2003 in which claims 1, 3-9, 21, 22 and 24-26 were rejected, claims 2, 10-20, 23 and 27-30 were objected to and claims 31-38 were allowed. In the Office Action, claims 1, 3-9, 21, 22 and 24-26 were rejected under 35 U.S.C. § 103(a) as being obvious from Sayre (U.S. Patent No. 5,175,808) in view of Applicants' statements in the background of the present application.

Sayre discloses a system for performing non-affine transforms on a pixel-by-pixel basis. Due to the complexity of performing non-affine transforms, Sayre divides the transforms into an x component and a y component. It then generates two displacement tables X and Y. The X displacement table indicates how each pixel in the source image should be displaced in the x direction based on the non-affine transform. The Y displacement

table indicates how each pixel in the source image should be displaced in the y direction based on the non-affine transform. Each pixel in the source image is then applied to the x displacement table to produce a temporary table that includes pixel values that represent the displacement of the pixels along the x direction. The y displacement table is then applied to the x displacement table to provide a modified y displacement table. The pixels in the temporary table are then applied to modified y displacement table to form a destination table of pixels. Note that each transformation is done on a pixel-by-pixel basis. The resulting destination table is ready for rendering simply by using the pixel values in the table.

Response to New Arguments in Final Action

In the Final Office Action, it was stated that Applicant's arguments in the response filed February 6, 2003 were not considered persuasive because Sayre was said to teach the claimed limitations. In particular, it was asserted that Sayre shows describing at least a portion of a base image as a path and performing a non-affine transform on the path instead of the individual pixels represented by the path at column 6, line 50 to column 7, line 36 and at column 11, line 45 to column 14, line 15. Applicants respectfully dispute these assertions.

In the cited section from column 6, line 50 to column 7, line 36, Sayre shows a way of defining the non-affine transform without needing to formulate a function that represents the transform. To do this, Sayre provides a graphical interface that shows individual knots connected by lines. The user is able to define the transform by moving the knots. Note that moving the knots does not involve transforming a base image. Instead, it is simply a tool for defining the transform that will be applied to a base image later. This is made clear at column 7, lines 29-36 where Sayre states:

> Once a mathematical function has been defined or knots have been moved and an approximating spline generated, then a displacement map is derived from the mathematical mapping, or model. The displacement map generated describes an X direction displacement and a Y direction displacement for each pixel in the source image. The displacement map contains displacement information to sub-pixel accuracy.

Thus, the knots define a spline and the spline defines displacement maps. These maps are applied to a base image on a pixel-by-pixel basis to transform the base image. Thus, the cited section clearly shows that Sayre does not transform a path that represents multiple pixels but instead transforms individual pixels using displacement maps.

The cited section from column 11, line 45 to column 14, line 15 (covering all of the claims) also fails to show the non-affine transformation of a path rather than the pixels represented by the path. In each claim, Sayre describes a system that transforms a "plurality of points" of a source image by applying an X displacement table to "each point of said source image". Thus, it is clear that Sayre is performing a pixel-by-pixel transform of the source image in the claims.

Thus, nothing in the cited section of Sayre shows or suggests performing a non-affine transform on a path that describes a portion of a base image instead of the individual pixels represented by the path and in fact, the cited section makes it clear that Sayre is performing pixel-by-pixel transforms.

In light of this, the invention of claims 1-38 are patentable over Sayre for the reasons discussed in detail in the response filed on February 6, 2003. The arguments presented in

the response of February 6, 2003 are repeated below for the sake of completeness.

Claims 1, and 3-9

Independent clam 1 is directed to a method of displaying an image on a screen by describing at least a portion of a base image as a path, where the path represents multiple pixels. A non-affine transform is performed on the path instead of the multiple pixels represented by the path to produce a transformed path. The transformed path is then rendered onto a computer screen.

In the Office Action, it was asserted that the present invention was obvious from the combination of Sayre and the statements regarding the prior art made in the background section of the present application. In the background section, Applicants noted that it has been known to perform simple affine transforms on paths that describe multiple pixels instead of on the individual pixels themselves. In the Office Action, it was asserted that since Sayre discusses performing non-affine transforms, it would be obvious to produce the present invention by performing non-affine transforms on paths rather than on individual pixels.

Although Sayre describes non-affine transforms, it does not suggest that such non-affine transforms can be performed on paths. Instead, Sayre reinforces the idea that before the present invention it was generally believed that non-affine transforms had to be performed on a pixel-by-pixel basis. The Sayre system is exactly the type of system that is alluded to in the background section of the present application in which non-affine transforms were only performed under the prior art by performing pixel-by-pixel transformations. This has been the state of the art even though it has been known to perform affine transforms on paths rather than on individual pixels. The reason

for this is that performing non-affine transforms is quite complicated as indicated by the numerous equations in the present application to transform a path using a non-affine transform and the numerous tables used by Sayre to perform a non-affine transform on a pixel-by-pixel basis.

In addition, Sayre indicates that there is a distinction in the art between affine and non-affine transforms. First, at column 2, lines 4-10, Sayre indicates that an affine transform is a "very simple transform". Second, Sayre notes that once the system moves away from affine transforms to non-affine transforms, the mapping functions, even on a pixel-by-pixel basis, become much more complicated in that performing pixel-by-pixel non-affine transforms creates artifacts, blurring, bottlenecks, and other problems. (See column 3, lines 15-17).

Thus, simply because the prior art had a mechanism for transforming paths for affine transforms does not mean that the same mechanism could be used for non-affine transforms, since non-affine transforms are much more complicated as indicated by Sayre.

Claims 3-4, 8

The Office Action rejected claims 3-4 and 8 by stating that "Sayre discloses a portion of the base image as a path comprises describing the portion using a function of order n and 2n(column 1, lines 46-62)." Applicants respectfully dispute this assertion.

The cited section of Sayre does not discuss a path of a base image. Instead, it describes a warping function, or transform, that is applied to the individual pixels of a base image. Thus, a "first order warp" is a linear function in which individual pixels of the base image are resized. Since Sayre is not discussing describing a portion of the base image as a function of order n, it does not teach or suggest the invention

of claims 3-4 or 8 where a portion of the base image is described by a function of order n, the transform results in a transformed function of order 2n and the transform produces a rational function of order n, respectively.

Claims 5-7

In rejecting claims 5-7, the Office Action asserted that "Sayre discloses the portion as a function of order one and three" at column 1, lines 46-62. However, the cited section does not disclose describing a portion of a base image as a path and as such, cannot disclose describing the portion of the base image as a function of order one or order three as required by claims 5 and 6. Instead, the cited section merely discusses the warping functions. In addition, the cited section does not disclose a perspective transform. As such, it does not show the invention of claim 7.

Claim 9

In rejecting claim 9, the Office Action asserted that Sayre discloses the step of approximating a transform path as a series of lines and rendering each line in the series at column 12, lines 45-66, Figures 2 and 5a-5d. Applicants respectfully dispute this assertion.

The cited section at column 12, lines 45-66 does not discuss approximating a transform path as a series of lines. Instead, it simply discusses a method of transforming individual pixels in a source image to a destination image on a pixel-by-pixel basis. In Sayre, the X and Y tables do not define lines. Instead, they simply contain individual displacement values.

In addition, Sayre does not discuss approximating any part of the transformed destination image. In other words, once the destination image pixels have been set through the process of Sayre's pixel-by-pixel transform, there is no further operation that needs to be performed to render the image on the display.

Instead, the pixels are simply taken from the resulting destination table.

Under the invention of claim 9, however, the transformed path is an equation. As a result, the equation cannot be rendered directly on to a display screen. Through the invention of claim 9, this is overcome by approximating the transformed path as a series of lines and rendering each line in the series. Sayre neither shows nor suggests the necessity of such steps or the manner in which such steps could be performed. As such, Sayre does not show or suggest the invention of claim 9.

Claims 21, 22 and 24-26

Independent claim 21 recites a computer-readable medium having computer executable components for performing steps comprising generating a function to describe an image for a computer screen; transforming the function using a non-affine transform to produce a transformed function; and converting the transformed function into an image on the computer screen. As noted above, neither Sayre nor the prior art discussed in the background of the application show a technique for transforming a function using a non-affine transform to produce a transformed function. In addition, transforming a function using a non-affine transform was not obvious from the prior art since non-affine transforms are much more complex than affine transforms, and the art had not been able to find a way to perform non-affine transforms of functions. As a result, the prior art, as clearly shown in Sayre, was forced to perform pixel-by-pixel transforms to obtain non-affine transforms.

Because of the complexity of performing non-affine transforms on functions, the present invention as found in claim 21 is not obvious from the prior art. As such, claims 21, 22 and

24-26 are not obvious from Sayre or the prior art mentioned in the background of the present application.

Claim 22

Claim 22 depends from claim 21 and includes a further limitation wherein the function that describes the image for a computer screen represents a smooth curve. In the Office Action, it was asserted that Sayre discloses a smooth curve at column 6, line 34 to column 7, line 36.

In Sayre, the spline found in column 6, line 34 to column 7, line 36 is used to define the transform that is applied to the individual pixels. As such, the smooth curve is not a function that is transformed, but instead is the transform function that is applied to the individual pixels. As such, Sayre does not show or suggest a smooth curve function that is transformed to produce a transformed function as required by claim 22.

Claim 24

Claim 24 depends from claim 23. Although claim 23 was objected to, claim 24 was rejected. This is inconsistent since if claim 23 is allowable, except for being dependent on a rejected base claim, claim 24 should be allowable as well.

In addition, Sayre does not disclose generating a function of order n to describe an image or transforming a function to form a transformed function of order 2n as required by claim 24. In the Office Action, it was asserted that Sayre shows this at column 1, lines 46-62. However, the cited section merely discusses possible transform functions, it does not discuss a function that describes a portion of an image or forming a transformed function of order 2n. As such, Sayre does not show or suggest claim 24.

Claim 25

Claim 25 depends from claim 21 and includes a limitation wherein transforming a function comprises using a perspective transform. In the Office Action, it was asserted that because Sayre states that the transform function can be a wholly arbitrary function, it necessarily discloses that the transform function is a perspective transform. Applicants respectfully dispute this assertion. Sayre has not explicitly stated that its function is a perspective transform. As such, it does not teach those skilled in the art to use a perspective transform. Those skilled in the art would have to know that a perspective transform exists before encountering the phrase "wholly arbitrary function" in Sayre. Thus, Sayre does not teach the use of a perspective transform and it certainly does not show applying a perspective transform to a function as required by claim 25.

Claim 26

Claim 26 depends from claim 21 and includes a limitation wherein converting a transformed function into an image includes converting the transform function into a series of lines and converting each line into an image. In the Office Action, it was asserted that Sayre shows these steps at column 12, lines 45-66 and Figures 2 and 5a-5d. Applicants respectfully dispute this assertion.

In the cited section, Sayre does not mention performing any steps on the destination pixels formed after the transform had been applied. In other words, Sayre does not need to perform any steps to render the transform pixels since the pixels are ready for rendering as soon as they are placed in the destination table. Under the present invention, however, the transform function cannot be displayed directly since it is in the form of a function. As a result, the transform function must be converted into pixels. Under claim 26, this is done by converting the transform function into a series of lines and converting each

line into an image. Sayre neither discloses the need for or a way to perform these steps. As such, Sayre does not disclose the invention of claim 26.

CONCLUSION

In light of the above remarks, claims 1-30 are patentably distinct from the cited art. Reconsideration and allowance of claims 1-30 is respectfully requested.

The Director is authorized to charge any fee deficiency required by this paper or credit any overpayment to Deposit Account No. 23-1123.

Respectfully submitted,

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